ADHESIVE BINDING METHOD AND DEVICE FOR CARRYING OUT THIS METHOD

This invention refers to a process according to the introductory part of claim 1 and a device according to the introductory part of claim 13.

The process of adhesive binding of sheets to be combined into a book block is carried out in such a manner that the back of the block of sheets, which in their entirety form the book block, is provided with adhesive material and is pressed together. According to this process the adhesive material can flow only in a direction across the back into the edge areas of the sheets at the joint to a minimum extent so that the bonding area is very small and so that only a very limited degree of strength of the bonding area is obtained.

A higher degree of strength is obtained by using the so-called fanning technique according to DE 103 41 493.2 with which the sheets forming the book block are fanned while the back of the not yet completed book block (in the form of the clamped sheets) is provided with adhesive material. By fanning the sheets the adhesive material is able to penetrate into the back of the sheets so that a larger bonding area is obtained.

On the one hand the fanning technique requires a special device, on the other hand, fanning the sheets of the block and applying the adhesive material is not as exact as required so that also this solution especially for small-scale series production is not satisfactory. Because the fanning and bonding process with sheets of thicker paper causes problems on account of the material, there is still no satisfactory solution available for binding book blocks from unusual, for example thicker paper, especially when making books in small-scale series.

It is an object of this invention to propose a process and a device for adhesive binding, by means of which book blocks can be made of sheets ofhigh quality, stiff paper, which are difficult to bond, which are made ready for adhesive bonding to obtain a substantially higher binding strength by a simple adhesive-applying technique, the opening characteristic of books is substantially improved, and especially an adhesive bonding of materials is possible, which materials up to now have been known as not being bondable by adhesive material.

According to the subject invention this object is solved by a process comprising the features of the characterizing part of claim 1 as well with a device comprising the features of the characterizing clause of claim 13. Further embodiments of the invention are the subject of the subclaims.

This invention makes it possible to manufacture and process the folding edge of sheets combined into a book block at the predetermined position, namely the binding edge in such a manner that the front sided and the rear sided or alternatively the first and the next following sheet have alternating recesses, which concerning their width and their length are used as adhesive receiving areas. In view of their identical pitch the adjacent sheets have equal alternating recesses so that with the compressed stack of sheets laterally shifted, longitudinally continuous free spaces with the thickness of the sheet are obtained for receiving adhesive material. In this manner an extremely firm adhesive binding is obtained at both sides. When turning over the sheets in their bound condition the sheets bend at the line which is determined by the transient of the throughgoing paper to the overhanging remaining part of 50%. The overhanging sheet parts are stuck so that they practically cannot move within an adhesive film so that such book blocks can be opened into a substantially flat position. This has the advantage that the individual pages can be copied free of distortions.

Processing the folding or sheet edges can be reached according to the invention by designing the cutting geometry of linear or alternatively circular cutting tools, especially knives. Preferably, double slot perforating knives or wheels can be used for sheet-wise processing double sheets (with four pages), whereby the halves of the sheets are connected with each other by small transversal webs. Providing circular or alternatively wheel-type knives is useful preferably with roller printers and folding machines. The tool is insertable into crucible/cylinder printing machines.

A different cutting geometry according to the invention is the meander type knives or wheels, which preferably can be used for multiple cuts, whereby the adjacent sheets are staggered by half a pitch. This meander-type design of cutting edges covers as well a rectangular meander shape as also a wave-like meander shape, a dovetail shape or the like.

With a double slit perforation the web between each of two adjacent recesses can be maintained. Subsequent to the slit perforating step the sheet is folded. According to an alternative method a sheet with full meander shape is cut or perforated and folded together, or alternatively an interrupted transversal cutting line is provided with an interrupted meander-type shape.

Alternatively, it is also possible to cut individual sheets separately and put them together, whereby the individual sheets are cut in the stack and shifted in view of each other. On the other hand the entire stack can be cut equally and subsequent thereto can be put together so that subsequent sheets are staggered by one tooth pitch of the perforation. Basically, individual pockets or recesses can be punched or cut and combined in a staggered manner relative to each other. This can be done by punching notches or milling

channels, whereby the stack of sheets is processed in such a manner that the sheets alternatively have a length changing by half a pitch and before punching/milling are pushed up, for example at the head cut and subsequent to punching/milling at the foot cut (or vice versa).

In the following the invention is described with reference to the drawings by embodiments represented in the drawings in purely schematic form.

Fig. 1 shows a schematic representation of the perforating knife system in front view.

Fig. 2 is a perspective view of a punching tool combined from two symmetrical punching elements according to fig. 1.

Fig. 3 shows a basic representation of a double folding line produced by the punching tool according to fig. 2.

Fig. 4 is a schematic view of two perforated sheets in the folded-up condition.

Fig. 5 shows a one-part punching tool.

Fig. 6 shows the cutting edge of the tool according to fig. 5.

Fig. 7 is another different embodiment of a one-part cutting tool.

Fig. 8 shows the cutting edge of the tool according to fig. 7.

Fig. 9 is a further embodiment of a cutting edge of a cutting tool.

Fig. 10 is a schematic, perspective picture of a number of adjacent perforation teeth in meander-type form with interruptions within the transversal webs, and

Fig. 11 shows a rotational punching tool a) in plan view, b) in front view and c) in perspective view.

In fig. 1 a double perforating knife 1 is shown, which consists of two individual perforating knives 2, 3. The knife teeth 4, 5 and the cutting edges 6, 7 are schematically shown. The two individual perforating knives 2, 3 have a

distance a from each other at least at the cutting edges, this distance a can be adjusted according to the thickness of the material of the sheet B to be perforated, and can be varied by additional spacers A. The perforation knives are releasably fastened by screws 8, 9.

The double perforation tool 1 is shown in a perspective view in fig. 2 showing its structure and its operation mode. The cutting edges or teeth 6, 6', 6'', ... are for punching the slots 10, 10', 10'', ..., the cutting edges or teeth 7, 7', 7'', ... are for punching the slots 11, 11', 11'', ... according to fig. 3. With a special embodiment of the invention the distance of the two perforation lines 12 and 13 is for example 0,6 mm, the length of a tooth 6 or 7 is for example 3,5 mm. Fig.4 shows a virtual folding line or hinge line 14 around which the two halves of a punched sheet are folded when making a book block, and based on the punched slots a fold strip 15 is formed the width of which is determined by the distance of the slots 10 and 11. The slots 10 and 11 each have a distance of a tooth width in the direction of the fold line, and are arranged leaving a gap, which means they are staggered by one tooth width. The perforation slots 10, 11 with this embodiment are not connected with each other by transversal webs so that when folding one sheet punched by a double perforating knife around the central folding line or hinge line 15, the resulting recesses 16, 17 are arranged leaving a gap in the longitudinal direction (along the folding line), and in their folded condition are bent around and are arranged joining each other so that the edge lines in total have a meander-like path. The surfaces of the recesses 16, 17 form the areas onto which adhesive material is applied so that when putting together and compressing the sheets into a book block alternating pairs of recesses of adjacent sheet halves lying one above the other are bonded together, which results in a high quality, long term bonding.

With another embodiment of the invention according to fig. 5 the double perforation tool 18 is a one-piece tool with which the cutting teeth 19, 19', 19'', ... and 20, 20', 20'', ... have a continuous meander-type path and punch as well longitudinal slots 21, 21', 21'', ... as also transversal slots 22, 22', 22'', ... connecting two adjacent opposite longitudinal slots with each other. The folding line or hinge line is marked with 23, and the recesses 24, 25 are folded alternatively in opposite direction around the hinge line so that when folding the sheets around the central line of the meander path, the recess areas are available for bonding with their full surface, whereas the transversal lines of the meander path form the hinge points.

A variation of Fig. 5 is shown in fig. 7. The cutting edge 26 of the perforation line has the shape of a dove tail similar thereto the perforation line also can be formed as a wave-type line.

With a further embodiment the cutting edge of a cutting tool the continuous cutting edge 27 in the transverse web 28 is discontinuous, for example with interruptions or perforations 29, as shown in fig. 9. In this embodiment a hinge connection each is left at the punching line of the transversal web, and two adjacent recesses of the sheet halves are connected with each other by said hinge connection so that a defined hinge axis is produced around which the sheet halves will be folded.

Instead of a linear cutting tool according to the preceding figures, fig. 10 shows a rotating cutting or punching tool which functionally corresponds with the punching knife shown in fig. 2, and is made-up of two symmetrical halves. With this type of punching knife perforation lines according to the tool shown in fig. 5 can be made.

Fig. 11 shows a rotating tool which similar to the linear tool of fig. 5 is made-up of two symmetrical halves, and results in perforation lines equivalent to those of the tool of fig. 5.